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about 3 minutes for the copper-based sorbent to be regenerated as evidenced by an increase of the concentrations of H₂ and SO₂ in the off gas. This result clearly demonstrates one advantage of embodiments of the presently disclosed sorbent systems as fast regenerable SO₂ absorbers.

Example 5

This example describes the evaluation of Pt—Ag—SiO₂ sorbent systems having different platinum concentrations. With reference to FIGS. 10 and 11, sulfation-desulfation tests were carried out using absorbents with different Pt loadings: 1 wt % Pt (sample 118), 0.1 wt % Pt (sample 120B), and 0 wt % Pt (sample 146). FIGS. 10 and 11 illustrate the steady state results that were obtained from the third sulfation/desulfation cycle. Although significant differences in the performances of samples 118 and 120B under lean/rich cycling conditions (see Table 6) were observed, these three samples only showed small differences in their performance under the sulfation/desulfation test. Pt in the absorbent contributes mostly to absorbents' full regeneration at low temperatures, which is important for their performance under lean-rich cycling conditions, especially when the engine is idling for extended periods of time. Without being limited to theory, it appears that the role of Pt is not to oxidize SO₂ to SO₃, facilitating formation of Ag₂SO₄, and this role appears to be adequately handled by the Ag component.

With reference to Table 6, each absorbent was prepared with 80-200 mesh particle size and subjected to cycling with 20 sec rich feed at 20K hr⁻¹ GHSV and 4 min lean feed with 25 ppm SO₂ at 50K hr⁻¹ GHSV, 2 hr test duration at each temperature. The absorbent samples were prepared according to the procedures set forth in Table 1.

TABLE 6

Screening test results of different Pt—Ag—SiO ₂ absorbent						
Sample I.D.	Absorbent composition	SO ₂ removal during lean cycles, %				
		550° C.	450° C.	350° C.	300° C.	250° C.
86D	1 wt % Pt—5 wt % Ag—SiO ₂	99	99	96	80	20
125A	1 wt % Pt—10 wt % Ag—SiO ₂	98	99	94	88	0
125B	2 wt % Pt—10 wt % Ag—SiO ₂	98	99	88	32	4
120B	0.1 wt % Pt—5 wt % Ag—SiO ₂	90	98	92	84	0
120A	0.5 wt % Pt—5 wt % Ag—SiO ₂	99	98	97	64	4
118	1 wt % Pt—5 wt % Ag—SiO ₂	98	99	98	88	12
128	2 wt % Pt—5 wt % Ag—SiO ₂	98	99	96	80	12
130A	1 wt % Pt—2.5 wt % Ag—SiO ₂	98	98	96	72	0
130B	1 wt % Pt—7.5 wt % Ag—SiO ₂	99	99	94	72	0
120C	1 wt % Pt—3.2 wt % Ag—SiO ₂	96	99	88	36	8

Example 6

This example describes the characterization of sorbent materials before and after cycling using microscopy and spectroscopy. Fresh, and 550° C. lean/rich cycled absorbents (sample 118) were analyzed using XRD, and TEM-EDS. With reference to FIG. 12, XRD patterns of fresh (bottom), and 550° C. lean-rich cycled (top) absorbent sample indicate that there is a modest increase in particle size, based on line broadening. FIGS. 13 and 14 show their XRD patterns and TEM images along with the EDS spectra. EDS spectra indicate that well-mixed Ag—Pt alloy was formed on the fumed silica support with the synthesis method used in this work. A slight metal sintering effect was observed after lean-rich cycling as the Ag/Pt alloy particles become more spherical. A modest particle size increase was observed based on XRD

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line broadening and TEM analysis. Also, EDS spectra show no detectable sulfur in the lean-rich cycled samples, indicating most sulfur is desorbed during the short rich cycles.

In view of the many possible embodiments to which the principles of the disclosed invention may be applied, it should be recognized that the illustrated embodiments are only preferred examples of the invention and should not be taken as limiting the scope of the invention. Rather, the scope of the invention is defined by the following claims. We therefore claim as our invention all that comes within the scope and spirit of these claims.

We claim:

1. A system for controlling the emissions of a combustion exhaust stream source, comprising:
 - first and second emission control devices, the first emission control device being upstream of the second emission control device;
 - wherein the first emission control device comprises a sorbent material comprising first and second catalytic materials and a carrier, wherein the first catalytic material comprises from about 0.1 weight percent to about 10 weight percent of a precious metal and the second catalytic material comprises from about 1 to about 50 weight percent silver;
 - wherein the first emission control device comprises a sulfur dioxide trap that is that is regenerable using a rich gas stream; and
 - wherein the sulfur dioxide trap is substantially completely regenerable in one minute or less.
2. The system of claim 1, wherein the precious metal in the first catalytic material is selected from the group consisting of platinum, palladium, ruthenium, rhodium and combinations thereof.

3. The system of claim 1, wherein the first catalytic material comprises platinum.

4. The system of claim 1, wherein the rich gas stream is a combustion exhaust stream.

5. The system of claim 1, wherein the rich gas stream comprises reformate.

6. The system of claim 1, wherein the second emission control device comprises a NO_x trap.

7. The system of claim 6, wherein all gas input to the NO_x trap is gas output from the sulfur dioxide trap and the NO_x trap is regenerable using the gas output from the sulfur dioxide trap during regeneration of the sulfur dioxide trap.

8. The system of claim 1, wherein the sulfur dioxide trap is regenerable using a combustion exhaust stream having a temperature of from about 200° C. to about 550° C.